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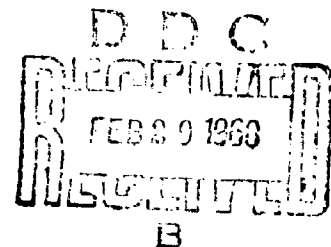
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**HAWAIIAN ISLANDS AND THE BARKING SANDS
TACTICAL UNDERWATER RANGE
FACILITIES: GEOGRAPHIC BACKGROUND**

By

**J. K. PRINCE
Geographer
Naval Missile Center**

1 February 1968



PACIFIC MISSILE RANGE

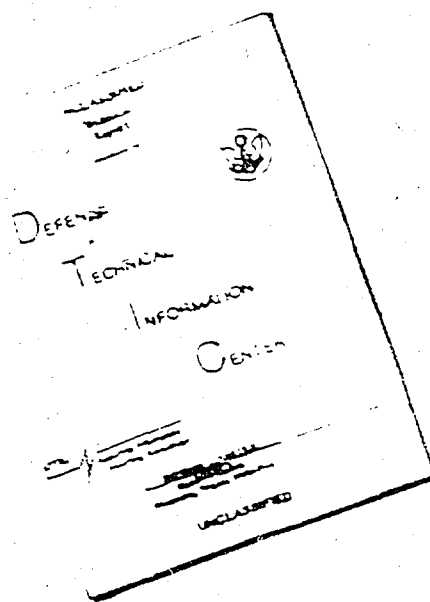
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GROUND

J.K. Prince

Pacific Missile Range
Point Mugu, California

February 1963

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INTRODUCTION

This technical note is intended to provide geographic and other background information to persons who have an interest in the Pacific Missile Range facilities at Barking Sands, Kauai, and in the State of Hawaii of which Kauai is a part.

The information set forth herein should be both useful and interesting to residents and visitors alike.

HAWAIIAN ISLANDS

Location and Size

The Hawaiian Archipelago in the north-central Pacific Ocean comprises eight large volcanic islands and a long chain of islets, reefs, and shoals that rise above an elongated submarine ridge and stretch southeast to northwest some 1,400 nautical miles (figure 1).

The State of Hawaii consists of all of the islands, islets, and reefs from the large island of Hawaii in the southeast to Kure Island in the northwest except Midway Islands. The atoll of Midway is a possession of the United States within a naval defensive sea area and is not a part of the State of Hawaii (figure 2). The state lies between the parallels of 18° and 29° north latitude and between the meridians of 154° and 179° west longitude. It extends farther south than any other state of the United States. The most northern island is about as far north as Tampa, Florida; the most southern is about as far south as Mexico City. Hawaii has a total land area of 6,415 square statute miles, a population (1960 census) of 632,772 (figure 3), and an estimated population for 1965 of 711,000. It ranks 47th in size and 43rd in number of inhabitants. Honolulu, the capitol and principal city, on the island of Oahu is 2,233 nautical miles from Los Angeles (figure 4).

Geologic History and Structure

The Hawaiian Archipelago stands on a submarine platform erupted from a zone of fissures on the ocean floor (figure 5). Volcanic activity is believed to have moved progressively toward the southeast. The completeness of the erosion cycle and its stage of development have proceeded in the same direction. The western portion of the chain, the leeward group, is almost completely eroded. Only a few rocky islets and coral atolls remain. The volcanoes that once existed have been eroded below sea level, and their truncated cones form the platform on which coral grew to form reefs and islands. The eight islands of the southeastern end, the windward group, are volcanic mountains of varying age and show various phases of development. They represent the remnants of 15 distinct volcanoes, 5 forming the island of Hawaii, 2 each forming Oahu, Maui, and Molokai, and 1 forming each of the other islands. Four volcanoes

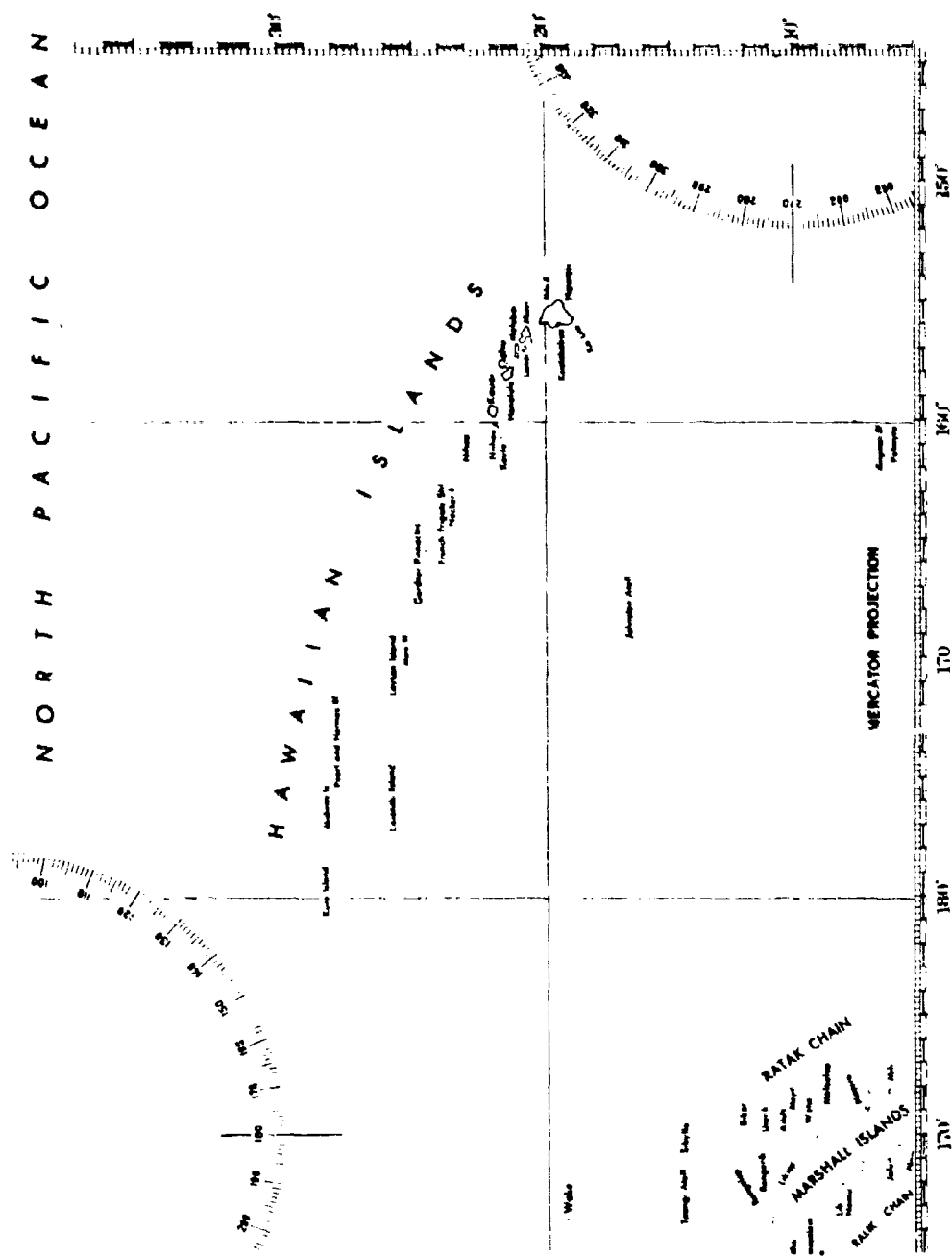


Figure 1. Location Map, Hawaiian Islands.

Mar. 18

HAWAII-ADMISSION INTO UNION

P.L. 86-3

Sec. 2. The State of Hawaii shall consist of all the islands, together with their appurtenant reefs and territorial waters, included in the Territory of Hawaii on the date of enactment of this Act, except the atoll known as Palmyra Island, together with its appurtenant reefs and territorial waters, but said State shall not be deemed to include the Midway Islands, Johnston Island, Sand Island (offshore from Johnston Island), or Kingman Reef, together with their appurtenant reefs and territorial waters.

Figure 2. Delimitation of the State of Hawaii. Section 2, Public Law 86-3.

have erupted in historic times, one on the island of Maui, and three on the island of Hawaii. The oldest domes, those at the western end of the windward group, are characterized by exceptionally heavy erosion, and deep canyons are evident where water action has scoured away the basaltic lava rock.

History and Government

The Hawaiian Islands were introduced to Europeans as a result of the third voyage of Captain James Cook, famous navigator of the British Royal Navy. Captain Cook first sighted the island of Kauai in January 1778, and anchored in Waimea Bay on the southwest side of the island on January 20th. The islands were named the Sandwich Islands in honor of the Earl of Sandwich, the First Lord of the British Admiralty. In 1779, after voyaging to North America, Captain Cook returned to the Hawaiian Islands where he was killed in a conflict with natives on the island of Hawaii.

Warlike chiefs ruled various islands until Kamehameha succeeded in establishing a Polynesian Kingdom and became undisputed ruler of the whole group. In 1894 a republic was declared, and in 1898 a petition from the Hawaiian Government was passed by the Congress of the United States annexing the Hawaiian Islands to the United States. In 1900 Congress established a territorial government for the islands, and the area was known as the Territory of Hawaii. By presidential proclamation on August 21, 1959, Hawaii officially became the 50th state of the United States.

Race and Language

The original people of the Hawaiian Islands were part of the Polynesian race whose ancestors are believed to have migrated eastward from Malaysia early in the Christian era. The main body of Polynesians settled in the Society Islands. From there, centuries later, Polynesian voyagers and explorers ranged out to occupy the islands from Hawaii in the north to New Zealand in the south and to the Tuamotu Archipelago and other islands in the east.

AREA AND POPULATION OF COUNTIES AND ISLANDS

County and Island	1960			
	Land Area in Square Miles	Total		Per Square Mile
		Number		
The State	5,415	632,772		98.6
Countries:				
Hawaii	4,021	61,332		15.3
Honolulu	598	500,409		836.8
Kalawao	14	279		19.9
Kauai	623	28,176		45.2
Mau	1,159	42,576		36.7
Islands:				
Hawaii	4,021	61,332		15.3
Kanoolawe	45	--		--
Kauai	551	27,922		50.7
Lanai	141	2,115		15.0
Meui	728	35,717		49.1
Molokai	259	5,023		19.4
Niihau	72	254		3.5
Oahu	1,598	250,409		836.8

¹Includes area (3 square miles) of outlying islands, part of Honolulu division.

²Includes population (15) of outlying islands, part of Honolulu division.

Figure 3. Census County Divisions in Hawaii, and Area and Population of Counties and Islands

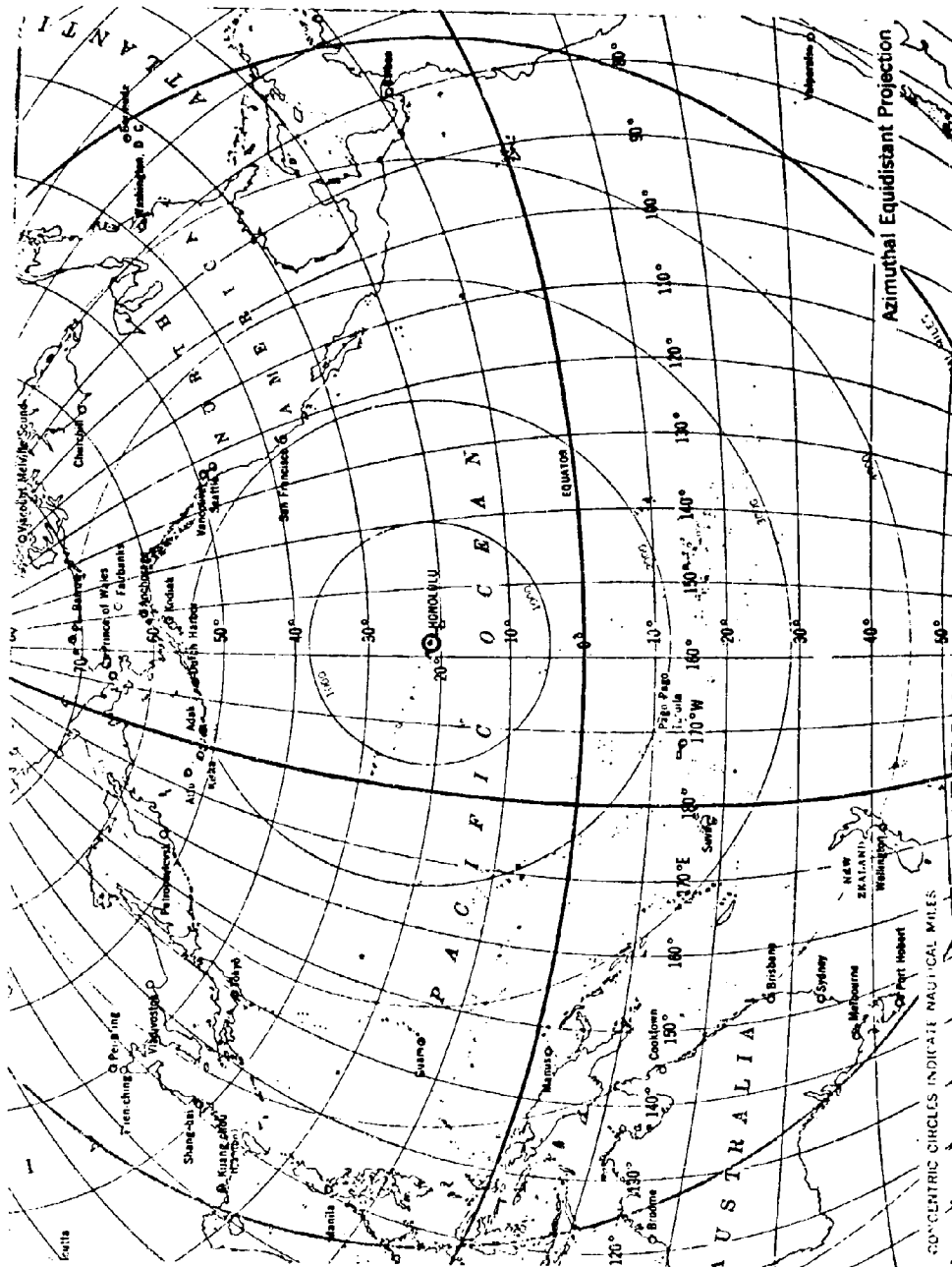


Figure 4. Map of Great Circle Distances and Azimuths From Honolulu, Oahu.

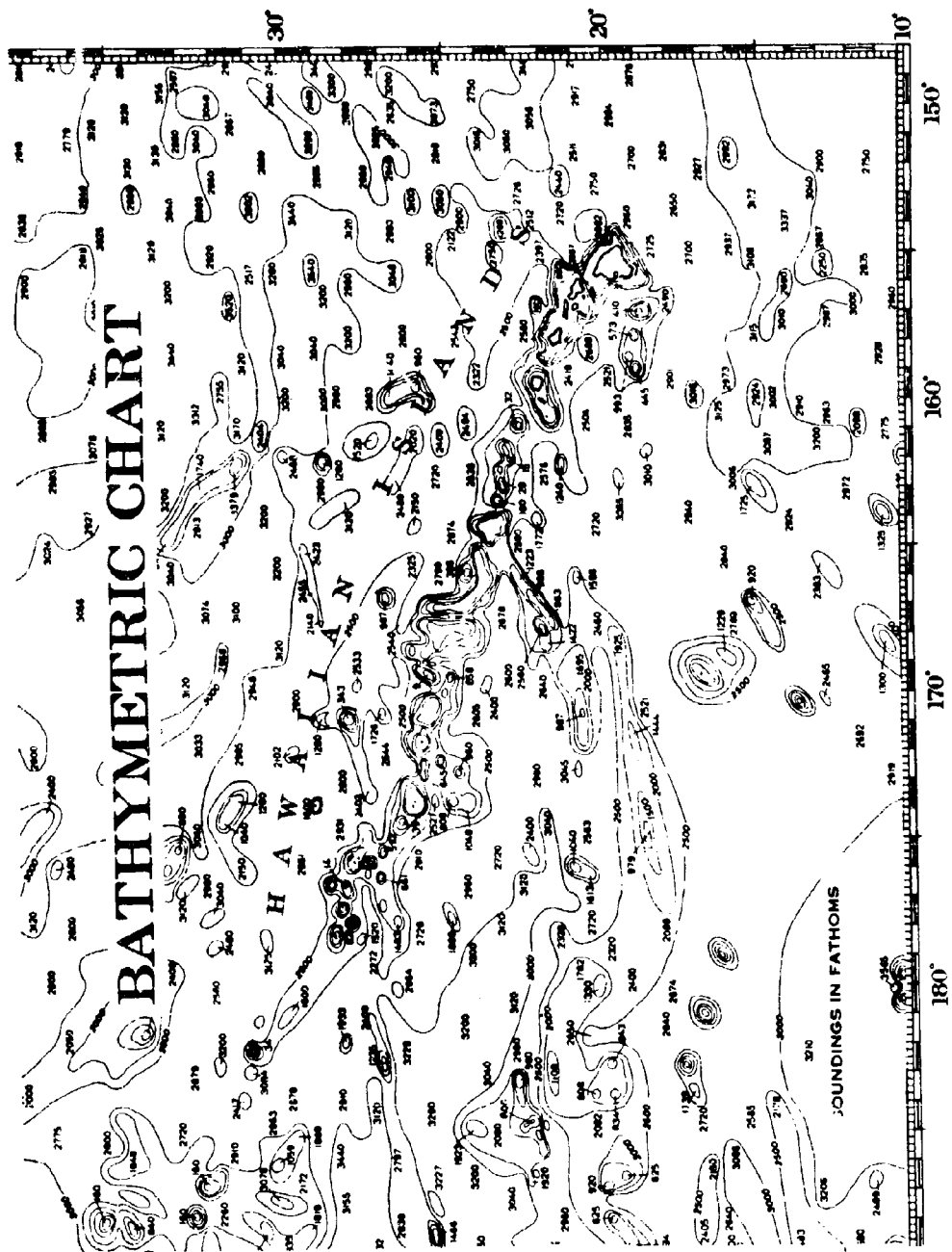


Figure 5. Bathymetric Chart of the Hawaiian Archipelago Area.

At the time of Captain Cook's visit, the Hawaiian Islands had a homogeneous population estimated to have been approximately 300,000. Travelers from Europe brought diseases against which the Hawaiians had no immunity and, as a result, the death rate increased sharply. By 1872 the population had dropped to 56,897. However, immigration from many different countries reversed this trend and eventually produced the extraordinary intermixing of races that is evident today.

There are enough similarities in the languages of the Hawaiians, Tahitians, Samoans, and the Maoris of New Zealand to establish their affinity and common progenitors. Today the language of Hawaii is English, but Hawaiian, Chinese, Tagalog, Japanese, and many other languages may be heard. The Hawaiian language is soft and musical with vowels and liquids predominating. Only 12 letters (the vowels and h, k, l, m, n, p, and w) are used to represent the 40 syllables that make up the more than 20,000 words. Today the place-names of the islands reflect much of the original Polynesian culture (table 1). Many of the names are difficult to translate because of their great antiquity and the changes they have undergone.

Biota: Flora and Fauna

The isolation of the islands and their great diversity of soil, relief, drainage and climate have led to the development of a unique and diversified flora. Many of the indigenous species are found nowhere else. There are more than 1,000 native flowering plants, including 300 kinds of trees, about 150 species of ferns (among them tree ferns 25 to 30 feet high), and hundreds of species of mosses, fungi, and algae.

The animals of the islands have likewise evolved into many species, with particularly large numbers of birds, insects, and crustacea. In contrast, there are but few land animals. There are no native reptiles or amphibians, and the only native land mammal is a bat. Domesticated animals brought to the islands by the Hawaiians included the pig, the dog, and the jungle fowl. The introduction of animals by Europeans was begun by Captain Cook in 1778 and by English navigator George Vancouver some years later.

Climate

The remarkable features of the climate of the Hawaiian Islands are the vast differences in rainfall over adjacent areas; the persistently equable temperature devoid of seasonal or sudden changes and with only a very moderate difference between the averages of winter and summer months; and the tenaciousness of the trade winds over the general locality.

Table 1. Glossary of Words Frequently Occurring in Hawaiian Geographic Names

A'a	rough lava	La	the sun
Ahina	gray	Lee	a cape
Ahina	a mound, a heap	Lani	the sky, heaven
Aina	land	Lapa	a narrow ridge
Aloa	red ochre	Lena	yellow
Ale	a wave	Liu	bilgewater
Aa	a cave	Loa	long
Ao	light	Loi	a taro patch
Apapa	a district	Loihi	long
Au	a current, time	Loko	a fish pond
Awa	a harbor	Lua	a pit, crater
Awa	a valley	Lua	two
Eyowho	a monument, cairn	Luu	to dive
Eleele	black	Makani	wind
Haiki	namow, close	Makani	calm
Hale	Pandanus tree	Makani	a branch of a stream
Hale	house	Makani	thick, broad
Hau	a tree, Hibiscus tiliaceus	Makani	a bird
Hihia	wild	Makani	a mountain
Hikina	east	Makani	ocean
Hina	gray	Moku	an island, a district
Hono	a harbor	Mokupuni	an island
Honua	land	Muliwai	a river
Hou	new	Ni	a coconut tree
Hu'a	sea foam	Nui	great
Ii	little	Nuku	a narrow entrance of a river or harbor
Ili	a division of land	Nuu	a terrace, steps
Itili	pebbles	Ohe	bamboo
Iwa	nine	One	sand
Ka	the	Pa	a fence, an enclosure
Kahawai	water course	Peakea	limestone
Kahiko	ancient	Pae	to land
Kahua	site, foundation	Pahoehoe	smooth
Kai	sea	Pahi	a place where there is a waterfall only in rainy weather
Kaikuono	bay	Pali	a precipice
Kala	rough, prickly	Peloto	clay
Kamani	a tree, Calophyllum inophyllum	Pohaku	a rock
Kapu	taboo	Poho	a dead calm
Kapua	a foot	Pono	right
Kauhale	village	Po'o	head
Kaa	white	Puu	post
Kee and K'ee	crooked	Puhi	to blow
Kela	muddy	Puka	an opening, a door
Ke'oke'o	white	Pau	a hill
Kini	numerous	Ua	rain
Ko	sugarcane	Uka	inland
Koa	a tree, Acacia koi	Ula and Ulaula	red
Kolu	three	Uli and Uliuli	blue
Kona	leeward	Uuku	little
Kou	a tree, Cordia subcordata	Waa	a canoe
Kowā	a channel	Waa	a furrow, channel
Kua	a back, a ridge	Waha	a mouth
Kakui	a tree, Aleurites moluccana	Wai	water
Kukul'eeo	stilts, the stilt plover	Waihu	a gushing fountain
Kula	dry upland	Waialele and Waihi	a waterfall

As a general statement it may be said that the climate of the Hawaiian Islands is unusually pleasant for an area situated at such a latitude. The north-east trade winds, blowing in from cool ocean areas, modify the temperature and carry a heavy load of moisture, much of which is dropped on the islands. Rough relief and a wide range in elevation produce great differences in temperature and rainfall within short distances.

For example, from windward to leeward slopes instances of pronounced and sudden decline in rainfall can be found. This is well illustrated in central Kauai, where, near the summit of Mount Waialeale, at an elevation of 5,075 feet, the average amount of rain is over 450 inches, while 15 miles southwest on the leeward side it is less than 20 inches (figure 6).

KAUAI
AVERAGE ANNUAL RAINFALL

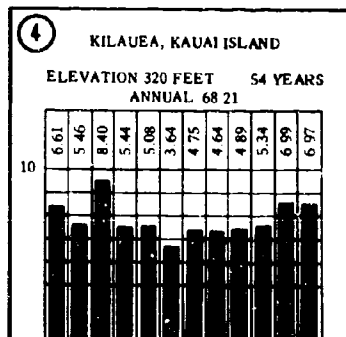
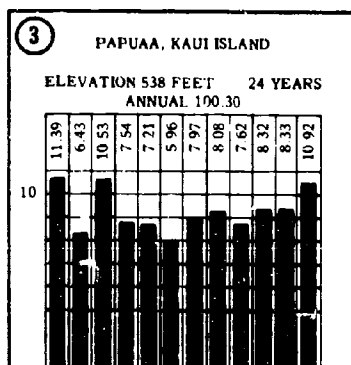
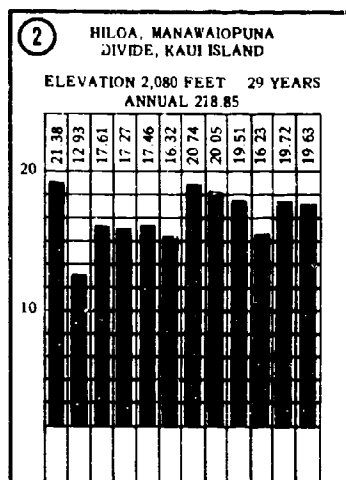
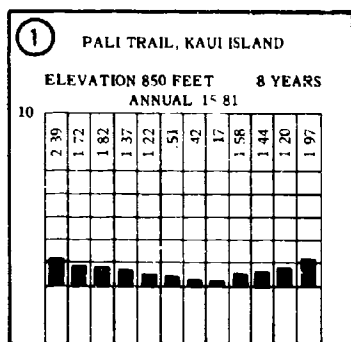
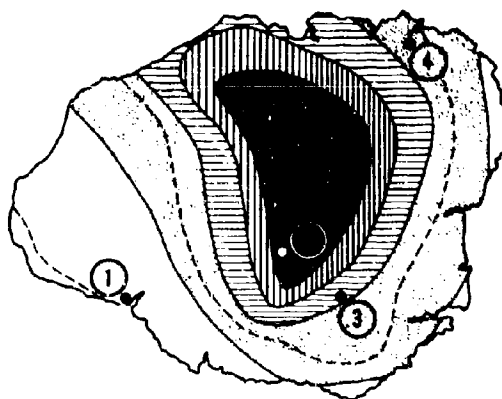
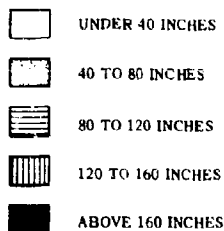


Figure 5. Rainfall Map of Kauai, With Monthly Distribution of Precipitation for Selected Stations.

The marked marine influence combined with the persistent trade winds permit relatively little uncomfortable heat. Discomfort is sometimes experienced when the trade winds temporarily give way to light changeable or southerly winds with resultant comparatively high humidity. In summer the trade winds blow with a high degree of persistency; the periods of so-called kona weather are most noticeable in the fall. The word kona, of Polynesian origin, means leeward. In the climatological sense it refers to the southerly winds and the accompanying weather on the normally leeward sides of the principal Hawaiian Islands, which have become, temporarily, the windward sides. The konas are the major element of climatic variation with time in the Hawaiian Archipelago. They cause the greatest portion of the differences between cool and warm seasons; they also bring rain to otherwise arid portions of the major islands.

Temperatures are generally lower than in similar latitudes and altitudes elsewhere. There is a decrease of temperature with rise in elevation. Freezing temperatures, frost, and snow rarely occur below 4,000 feet. Thunderstorms are infrequent and practically never severe. Hail seldom occurs. Local storms are occasionally accompanied by winds of sufficient force to do limited damage to trees and other property, but severe storms such as tornadoes, hurricanes, or typhoons are very uncommon. So-called thick weather is almost unknown and usually confined to mist or rain, but on rare occasions fog may develop for a day or two.

Tides and Currents; Ocean Temperature and Salinity

The periodic tides in the Hawaiian Islands are small; the average rise and fall is only 1 to 2 feet. The tides along the southern coasts of islands occur 1 to 1 1/2 hours later than along the northern coasts, with high water intervals of 2 to 4 hours. Tidal currents are generally weak and are influenced by winds and oceanic movements. In the channels between the larger islands, tidal currents are mainly reversing, but they are rotary in more open waters, and continually shift direction in a clockwise movement. Oceanic currents are variable but generally depend on the velocity and direction of the wind. Great seismic sea-waves or tsunamis have visited the islands from time to time and cause widespread destruction and loss of life. The United States Coast and Geodetic Survey administers a sea-wave warning system that alerts the Hawaiian Islands, other Pacific islands, and most of the countries bordering the Pacific.

Seasonal changes of ocean surface variables are relatively small. The seasonal surface water temperature range, for example, is approximately 4° to 5°F. The mean summer high is about 78°F and varies locally from 75° to 80°F. The mean winter low is about 74°F, with local variations from 73° to 76°F. The mean salinity is about 35‰ (parts per thousand), ranging from 34.4‰ to 35.3‰ (see appendix for detailed charts).

ISLAND OF KAUAI AND THE BARKING SANDS TACTICAL UNDERWATER RANGE FACILITIES

Location

The Barking Sands Tactical Underwater Range (BARSTUR) is located in a 50-square-mile ocean area in the north-central Kaulakahi Channel that separates Kauai some 15 nautical miles from the privately owned island of Niihau to the west. The support facilities for the underwater range are located on the low western coastal plain of the island of Kauai. Included are an instrumentation site to the east on Niu Ridge at an elevation of 760 feet, and an instrumentation complex some 5 miles northeastward on Makaha Ridge at an elevation of about 1,500 feet (see figures 7 through 10).

Kauai, the northernmost island of the Hawaiian windward islands and fourth largest of the eight major islands in the southeastern part of the archipelago, is located at 22°05' north latitude and 159°30' west longitude. The island measures about 33 statute miles east to west by 25 miles north to south; it is roughly circular, with a land area of 551 square statute miles. Kauai has a population of 27,922 according to the 1960 census. (Additional census information is presented in the appendix.)

Physical Geography

Kauai is the deeply eroded and dissected remains of a former volcanic dome that now culminates in the central part of the island in Kawaikini peak at an elevation of 5,170 feet, the highest point on the island (figures 11 and 12). The former caldera that extends northwestward and is now filled by erosional deposits forms a 4,000-foot-high upland that is occupied by the boggy Alakai Swamp. The mountains on the west and north sides are deeply dissected by numerous streams that have cut deep gorges and left steep, jagged ridges. The slopes on the east and south are gullied, and a coastal plain extends seaward from the mountain flanks. The northwest Na Pali coast is steep-to and backed by high bluffs where the elevated upland drops abruptly to the sea.

A coastal alluvial plain extends 2 or 3 miles inland and fringes the west side of the island for about 10 miles--from the Waimea River around Kokole Point northward to the Barking Sands area beyond Nohili Point. The Barking Sands sand hills, a dune area composed of sand, white coral, and lava fragments, received their name because of the peculiar woofing noise they make when skidded on or rubbed. The shore of the western coastal plain is largely sand dunes and windblown deposits; the eastern edge of the plain is marked by talus deposits along prominent, abrupt cliffs that front the mountainous slopes. The coast along the south and east is low and rocky, with some sandy beaches. The 20-fathom depth curve is seldom more than a mile from shore and is usually not far from the coral reefs that fringe parts of the coast.

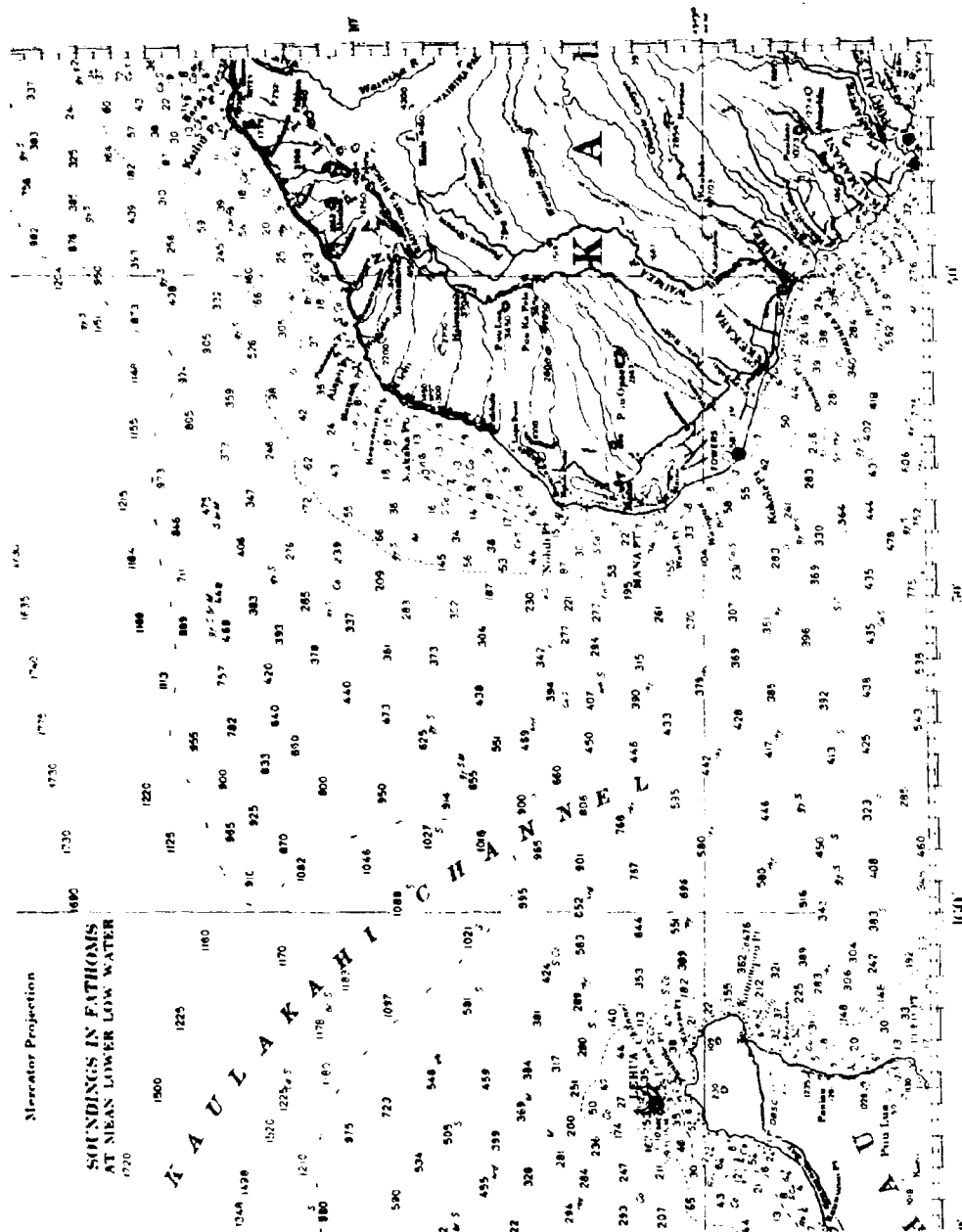


Figure 7. Hydrographic Chart of Kaulakahi Channel.

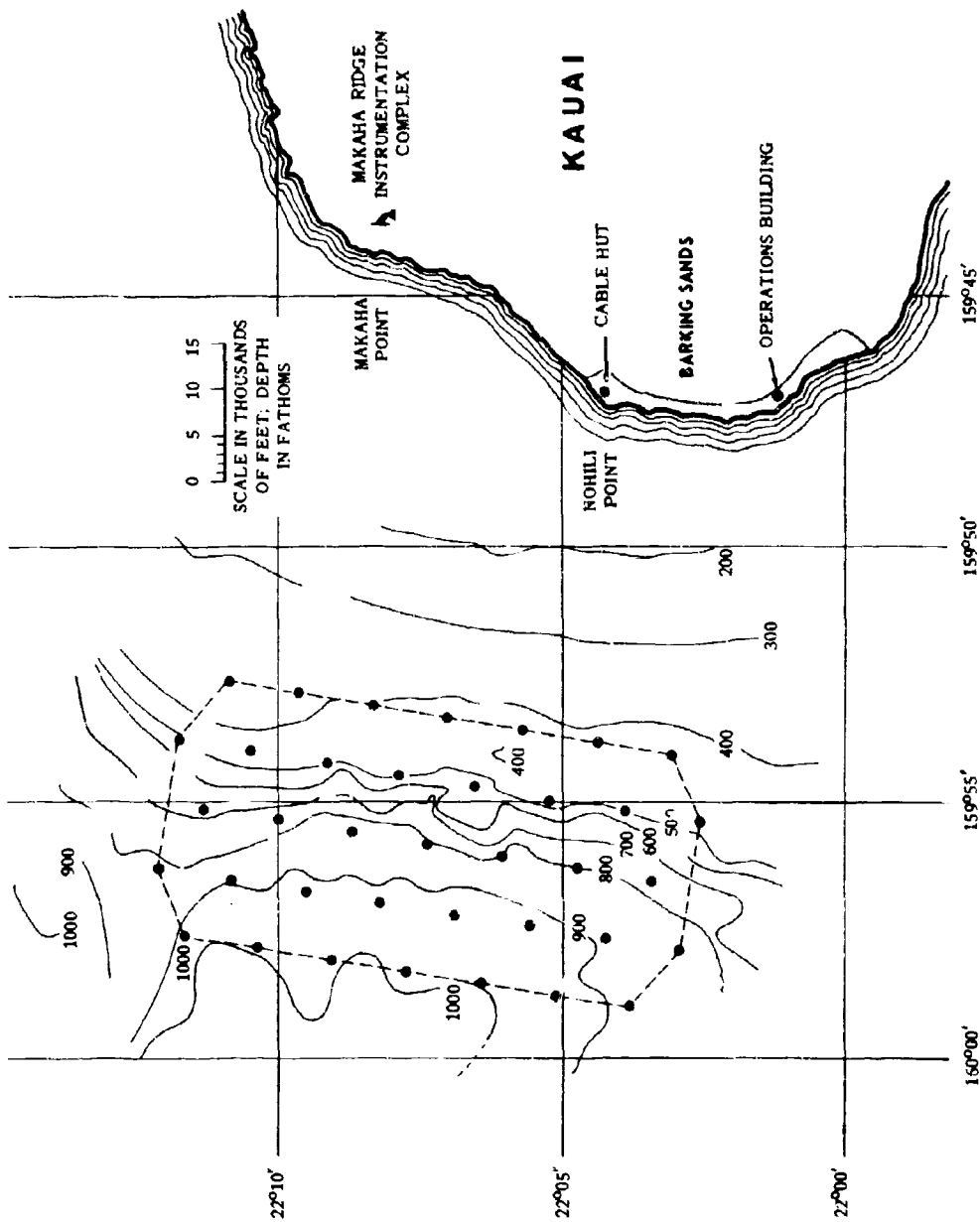


Figure 8. Location Map, Barking Sands Tactical Underwater Range and Facilities.

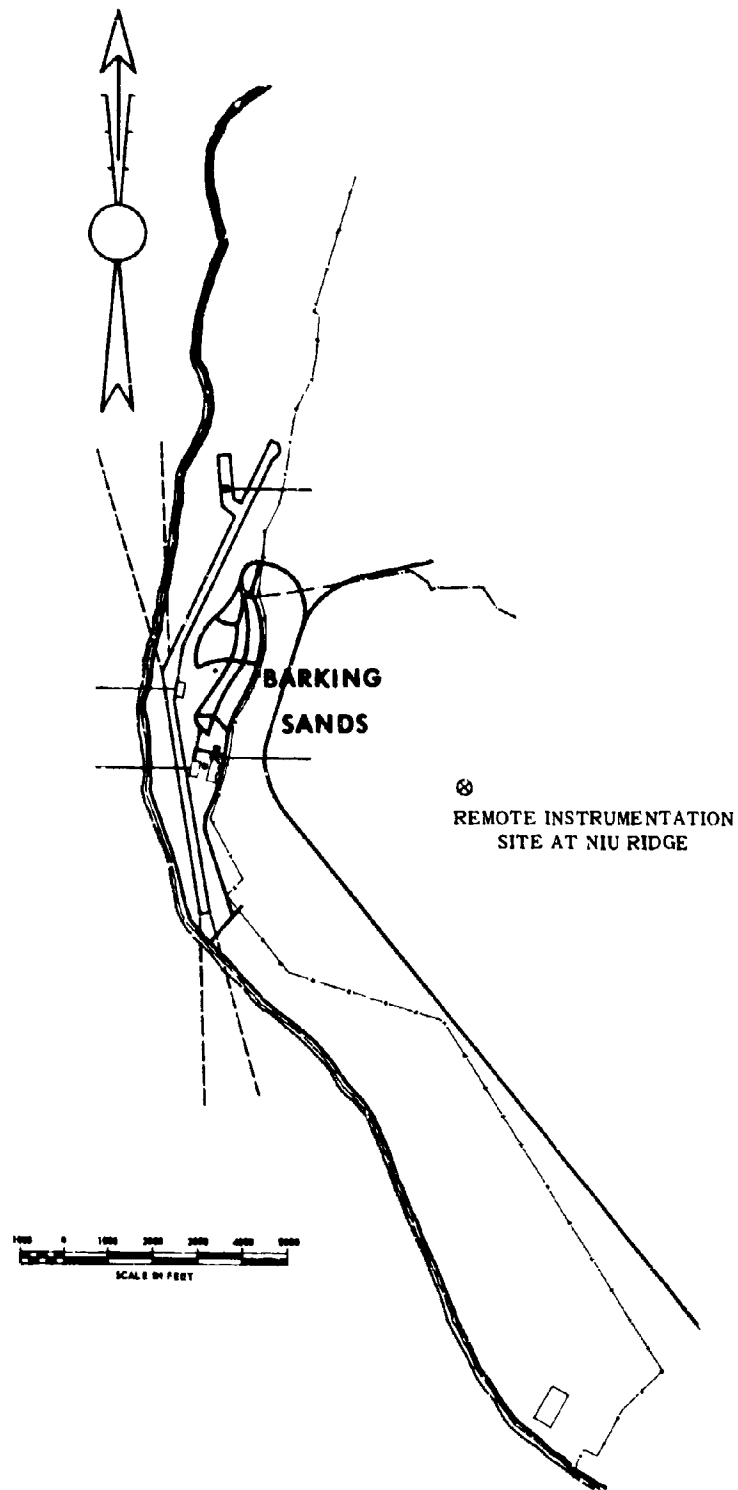


Figure 9. Site Map of Barking Sands Facilities.

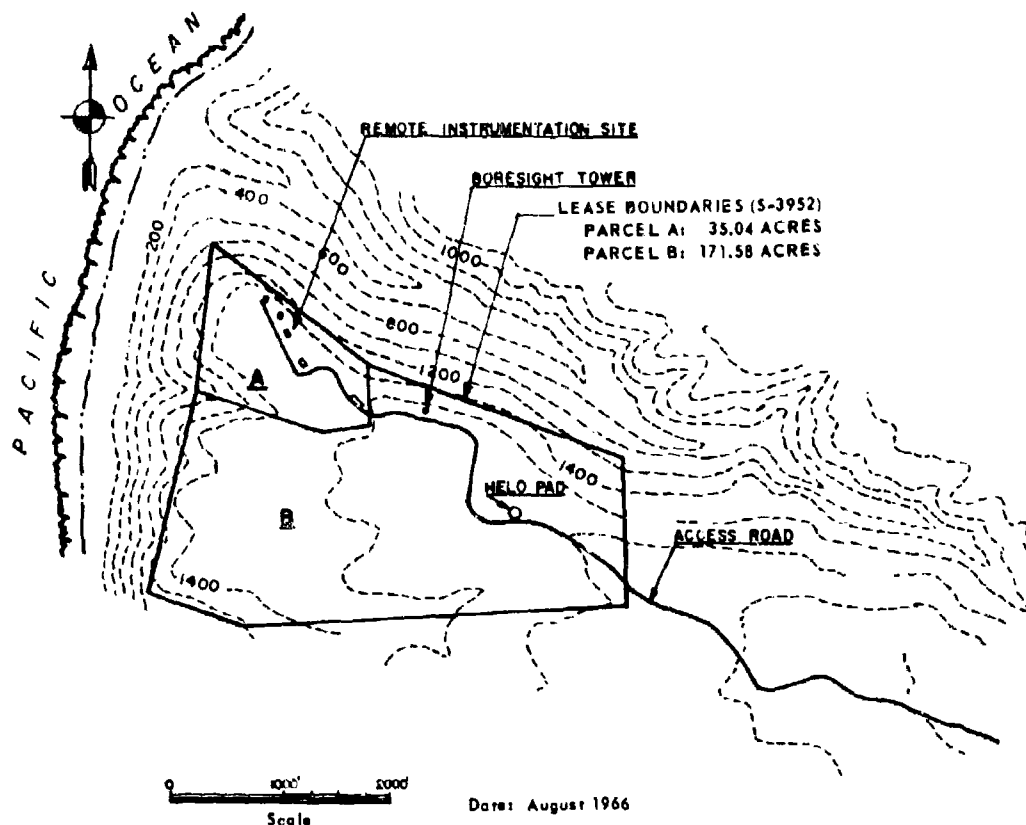


Figure 10. Site Map of Makaha Ridge Instrumentation Complex.

Waimea Canyon, often called the Grand Canyon of the Pacific, is the spectacular, deeply cut valley of the Waimea River. The canyon, which heads in the west-central highlands, is about 10 miles long, nearly 3,000 feet deep, and a mile wide. The upper canyon and its tributaries form the southeastern edge of the plateau that drops off to the northwest along the Na Pali coast. The coast, which is inaccessible except by helicopter or boat, includes several state parks.

There are some local variations from the general climatic pattern of the Hawaiian Islands (see tables 12 and 13 in appendix). The trade winds tend to divide on the easterly side of Kauai. Part of the windflow follows the north coast and part the south coast. On the west side between Mana and Makaha Points, calm to light variable airs prevail, although north to northwest winds are found slightly inland at Mana. Toward the southwest coast, a moderate southwest wind sometimes occurs at Waimea Bay while a strong east wind is blowing about 2 miles offshore. At Makaweli, easterly winds prevail during most months.

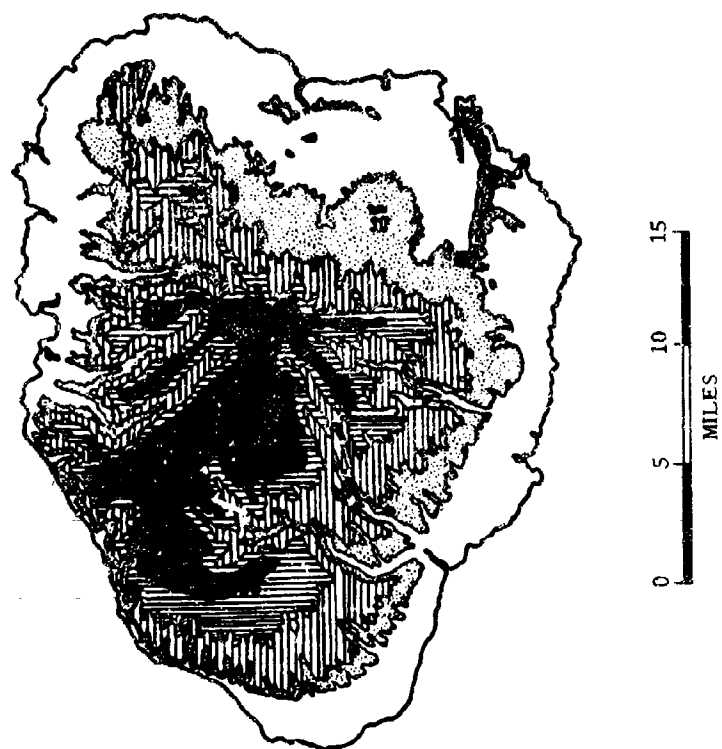


Figure 1'. Elevation Map of Kona.

Ocean currents around Niihau are usually from north to south, but currents through the channel between Niihau and Kauai are usually from southeast to northwest. These currents are extremely variable, especially during the winter months when strong southerly and southwesterly winds occur. Currents around Kauai are also quite variable, usually following the winds, but sometimes reversing during the first calm after strong trade winds.

Transportation and Accommodations

Kauai is called the Garden Isle of the islands and tourism vies with agriculture (sugarcane, pineapple, cattle) as the most important industry. Hawaii's two scheduled airlines, Aloha Airlines and Hawaiian Airlines, provide many daily flights to Kauai. There are also a number of certified, dependable air taxi services operating between the islands. The 95-mile flight from Honolulu to Lihue, the principal town and county seat of Kauai, takes about 25 minutes. There are no scheduled commercial flights to any other points on the island except Lihue, although there are airfields at Port Allen and at Barking Sands.

Lihue Airport is situated about 2 miles from the town. Rental cars and transportation to various island hotels are available. The Hawaii Visitors Bureau Visitor Information Center is located at the airport.

The standard time used in most of Hawaii is 10 hours slow of Greenwich Mean Time; 2 hours earlier than Pacific standard time.

There are no accommodations (table 2) for visitors at the Barking Sands facility. Most of the hotels and motels are located in the Lihue area or along the south coast in the Port Allen/Poipu area. The east coast features accommodations and resort hotels in the Wailua/Kapaa area and north at Hanalei. Rates for accommodations and meals at most resort hotels are moderate to high. See table 3 for mileage and driving times.

The island of Kauai has grown as a tourist attraction and offers a great variety of outdoor activities. There are bathing beaches and such offshore water sports as surfing, water-skiing, outrigger canoeing, deep sea fishing, and coastal cruising. Hiking, golf, horseback riding, and mountain goat and wild boar hunting are also available. Visits to historical sites and scenic localities, including the Fern Grotto, and rides by river launch on the Wailua River are always popular.

Directions to the Barking Sands Facility

To reach the Barking Sands facility from Lihue Airport, one follows the main road through Lihue and on southwest along the southern coast of the island. The road, State Highway 50, winds through fields of sugarcane to Port Allen. At Port Allen, one of the island's two major harbors, berthing space for ships that

Table 2. Accommodations on Kauai

Lihue Area:	
Kauai Surf	
Hale-Ka-Lani Motel	
Hale Lihue	
Hale Pumehana	
Hi-Way Motel	
Motel Lanai	
Palm Haven Hotel	
Port Allen/Poipu Area: West of Lihue, South Coast	
Jerves Motel	
Waiohai	
Prince Kuhio Hotel and Apartments	
Polynesia Inn	
Poipu Shores	
Garden Isle Beach Apartments	
Poipu Beach	
Waimea/Kokee Area: West of Lihue, Southwest Coast	
Kokee Lodge	
Menehune Manor	
Wailua/Kapaa Area: North of Lihue, East Coast	
Coco Palms Resort Hotel	
Tropical Inn	
Lihi-Kai	
Wailua Crest	
Hotel Coral Reef	
Hanalei Area: North of Lihue, North Coast	
Hanalei Plantation	
Hanalei Apartments	

Table 3. Mileage and Driving Times

From Lihue south to:		
Poipu	14 miles	40 minutes
Waimea	25 miles	1 hour
Kekaha	29 miles	1 hour 5 minutes
Waimea Canyon	40 miles	2 hours
Kaialau Lookout	50 miles	2 hours 10 minutes
From Lihue north to:		
Wailua River	7 miles	20 minutes
Hanalei	35 miles	1 hour 15 minutes
Haena	41 miles	1 hour 30 minutes

support the underwater range has been provided by the State of Hawaii. Port Allen on the south coast and Nawiliwili on the east coast are the only commercial harbors and the only places that afford shelter in almost all types of weather. They are ports for a few interisland barges and transpacific vessels. Most interisland passenger traffic is by air.

Continuing along the south coast, 25 miles from Lihue and about 1-hour driving time, the settlement of Waimea at the mouth of the Waimea River is reached. Here is the site of Captain Cook's first Hawaiian landing and, in the past, a favorite provisioning port of Pacific traders and whalers. Here also one may see the ruins of a fort built in 1815 by the Russian Fur Company, which hoped to seize Kauai for the Czar. The United States Department of Interior has suggested this site as a historical monument.

Twenty-nine miles from Lihue at the town of Kekaha, the road branches with the road to Barking Sands continuing along the coast. The road from Kekaha runs along the west coast for about 8 miles to the settlement of Mana. The land is relatively flat and nearly all planted to sugarcane. The Barking Sands facility lies along the coast west of Mana. The remote instrumentation complex at Niu Ridge is reached by sugar plantation roads south and eastward of Mana.

At Kakaha where the road branches, the Waimea Canyon road leaves the coastal fields of sugarcane and winds northward up arid, cactus-covered hills along Puehu Ridge to an elevation of about 2,200 feet, where it reaches the rim of Waimea Canyon. The road continues along the canyon rim to Kokee State Park, a distance of some 16 miles from Kakaha.

Three miles farther, some 50 miles from Lihue, the road ends at Kalalau Lookout, where the upland drops off some 4,000 feet through a lush green valley to the Pacific Ocean. The remote instrumentation complex at Makaha Ridge is reached by a 4 1/2-mile access road that heads west from the Waimea Canyon road south of Kokee Park. The National Aeronautics and Space Administration's Kokee satellite and missile tracking station is located near the junction of the Makaha Ridge access road.

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APPENDIX

Table 4. List of Available Hawaiian Island Charts, U.S. Naval Oceanographic Office and U.S. Coast and Geodetic Survey

Chart	Title and Contents of Charts	Scale		Edition		
		Natural 1-	Inch To Mile	No.	Date	Price
U. S. NAVAL OCEANOGRAPHIC OFFICE CHARTS						
5355	Approaches to Johnston Island	200,000	0.36	1	Apr 1964	2.00
5356	Johnston Island and Reef	25,000	2.92	6	Apr 1964	2.60
5652	Hawaiian Islands Area - Eastern Part	3,130,860	0.02	1	Mar 1939	2.00
5655	Hawaiian Islands to Samoa	3,371,450	0.02	1	Jan 1942	2.60
U. S. COAST AND GEODETIC SURVEY CHARTS						
14000	Hawaiian Archipelago	3,121,170	0.02	8	Apr 1965	.75
14001	Hawaii to French Frigate Shoals	1,650,000	0.04	4	Oct 1963	1.00
4171	French Frigate Shoals Anchorage	25,000	2.92	2	Jul 1965	1.00
4172	French Frigate Shoals	80,000	0.91	2	Apr 1965	1.00
4173	Gardner Pinnacles and Approaches Plan: Gardner Pinnacles (Not shown on Index)	100,000 20,000	0.73 3.65	1	Jan 1947	1.00
4174	Moro Reef	80,000	0.91	1	Feb 1945	.75
4175	Pearl and Hermes Reef	40,000	1.82	1	Feb 1947	1.00
4176	Midway Islands	10,000	7.30	5	Aug 1961	FOUR
4177	Kure Island	20,000	3.65	1	Feb 1946	.50
14179	Hawaiian Islands, Southern Part	675,000	0.11	3	Aug 1965	.75
14180	Hawaiian Islands, Northern Part	675,000	0.11	4	Nov 1964	.75
14181	Nihoa Island to French Frigate Shoals Plans: Necker Island Nihoa	663,392 20,000 20,000	0.11 3.65 3.65	2	Nov 1963	1.00
4182	French Frigate Shoals to Laysan Island	653,219	0.11	1	Feb 1941	1.00
4183	Laysan Island to Kure Island	642,271	0.11	3	Dec 1964	1.00
4185	Midway Islands and Approaches	80,000	0.91	2	Aug 1965	1.00
4186	Laysan and Laysan Islands Plans: Lisianski Island Laysan Island West Coast of Laysan Island	40,000 40,000 10,000	1.82 1.82 7.30	1	Dec 1942	1.00
4188	Midway Islands	32,500	2.25	3	May 1963	1.00

Includes LORAN lines of position.

Table 5. List of Available Charts, Hawaii to Nihoa, U.S. Naval Oceanographic Office and U.S. Coast and Geodetic Survey

Chart	Title and Contents of Charts	Scale		Edition		
		Natural 1:	Inch To Mile	No.	Date	Price
U.S. NAVAL OCEANOGRAPHIC OFFICE CHARTS-- FOR OFFICIAL USE ONLY						
1800	Pearl Harbor	12,500	5.84	24	Jun 1963	
Anchorage Charts						
Anch DA	Port Waiānae	10,000	7.30	1	Feb 1952	
Operating Area Charts						
5695-0A	Hawaiian Islands (Hawaiian Operating Areas)	600,000	0.12	11	Jan 1965	
5696-0A	Oahu Area (Hawaiian Operating Areas)	219,000	0.33	5	Jul 1963	
5697-0A	Area West of Oahu (Hawaiian Operating Areas)	248,260	0.29	4	Jul 1963	
5698-0A	Hawaiian Operating Areas, Maui, Molokai, Lanai, and Kahoolawe Area	80,000	0.91	2	Mar 1965	
5699-0A	Kahului Harbor and Approaches (Island of Maui) (Hawaiian Operating Areas)	30,000	2.43	3	Aug 1965	
	Plan: Kahului Harbor	10,000	7.30			
U.S. COAST AND GEODETIC SURVEY CHARTS						
4100	Island of Kauai	80,000	0.91	1	Sep 1959	1.00
4101	Mahukona Harbor and Approaches	5,000	14.59	2	Jan 1931	.25
4102	Hawaiian Islands	600,000	0.12	20	Jul 1964	1.00
4103	Hilo Bay--Island of Hawaii	10,000	7.30	14	Jan 1965	.50
4104	Maula Bay (Island of Maui)	10,000	7.30	4	Jun 1964	1.00
4108	Port Allen (Kauai)	5,000	14.59	10	Aug 1965	.25
4109	Honolulu Harbor (Island of Oahu)	5,000	14.59	25	Aug 1965	1.00
	Plan: Continuation of Keolu Lagoon Harge Channel (Not shown on Index)	5,000	14.58			
4110	Island of Oahu	80,000	0.91	8	Jan 1964	1.00
4111	Nawiliwili Bay (Kauai)	5,000	14.59	11	Sep 1965	.50
4112	Hanalei Bay (Kauai)	2,500	29.19	4	Aug 1939	.75
4113	Hana Bay (Maui)	5,000	14.59	3	Oct 1941	.25
4114	Approaches to Waimea Bay	10,000	7.30	3	Jul 1963	.75
4115	Island of Hawaii	250,000	0.29	8	Sep 1963	1.00
4116	Hawaii to Oahu	240,000	0.29	12	Aug 1964	1.00
4117	Oahu to Nihoa	247.482	0.30	7	Aug 1965	1.00
4118	Iiwa Point to Kapehu Point (North Coast of Kauai)	20,000	3.65	1	Mar 1930	.75
4120	Channels between Oahu, Molokai, and Lanai	80,000	0.91	1	Mar 1942	1.00
4121	Harbors of Molokai			4	Oct 1937	.75
	Plans: Kaunakakai Harbor	5,000	14.59			
	Pukoo Harbor	5,000	14.59			
	Kamalo Harbor	5,000	14.59			
	Kolo Harbor	5,000	14.59			
	Papohaku Roadstead	5,000	14.59			
4122	Kaunaloa Harbor (Lanai)	2,500	29.19	1	Nov 1929	.25
4123	Kealahou Bay to Honaunau Bay	10,000	7.30	1	Jul 1928	.50
4124	Kahului Harbor and Approaches (Island of Maui)	30,000	2.43	3	May 1965	.75
	Plan: Kahului Harbor	10,000	7.30			
4125	Approaches to Lahaina--Island of Maui	15,000	4.86	1	Mar 1965	1.00
4130	Channels between Molokai, Maui, Lanai, and Kahoolawe	80,000	0.91	4	Aug 1964	1.00
4131	Southeast Coast of Oahu--Waianae Bay to Diamond Head	20,000	3.65	4	May 1950	1.00
4132	South Coast of Oahu--Diamond Head to Pearl Harbor Entrance	20,000	3.65	11	Apr 1964	1.00
4133	South Coast of Oahu--Ahua Point to Harbors Point	20,000	3.65	6	Apr 1964	.75
4134	Kaneohe Bay (Oahu--East Coast)	15,000	4.86	3	Jun 1964	1.00
4140	West Coast of Hawaii--Cook Point to Upolu Point	80,000	0.91	2	Jun 1964	1.00
4161	Paaahu Landing	5,000	14.59	1	Oct 1933	.50
4162	Harbors and Landings on the Northwest and Southeast Coasts of Hawaii			1	Apr 1931	.75
	Plans: Kukuiahe Landing	2,500	29.19			
	Honokaa Landing	2,500	29.19			
	Punaluu Harbor	2,500	29.19			
	Honuaa Harbor	2,500	29.19			
4163	Keauhou Bay	2,500	29.19	2	Sep 1956	.25
4164	Kailua Bay	5,000	14.59	1	Aug 1932	.25
4167	Kaunakakai Bay	10,000	7.30	2	Jun 1959	1.00

Includes LORAN lines of position.

Table 6. Transpacific Distances

Figure at intersection of columns opposite ports in question is the nautical mileage between the two. Example: San Francisco, California, is 2091 nautical miles from Honolulu, Hawaii.

Panama Canal (Pac. Ent.)	San Diego, Calif.	Long Beach, Calif.	Los Angeles, Calif.	San Francisco, Calif.	Astoria, Oreg.	Portland, Oreg.	Cape Flattery, Wash.	Swiftsure Bank, Wash.	Seattle, Wash.	Keelikan, Alaska	Sitka, Alaska	Cape Spencer, Alaska	Seward, Alaska	Anchorage, Alaska	Kodiak, Alaska	Unimak Pass, Alaska	Uk Bay, Alaska	Pilo, Hawaii	Kauai, Hawaii	Kahului, Hawaii	Honolulu, Hawaii	Pearl Harbor, Hawaii	Nawiliwili, Hawaii	Port Allen, Hawaii	Midway Islands	28°13.0'N., 177°32.0'W.
2637	94	33°43.0'N., 117°10.5'W.	33°46.2'N., 118°13.3'W.	33°45.0'N., 119°16.2'W.	37°48.5'N., 122°24.0'W.	46°11.7'N., 123°50.0'W.	45°33.0'N., 124°41.7'W.	48°26.0'N., 124°47.0'W.	48°31.0'N., 125°00.0'W.	47°36.2'N., 122°20.3'W.	55°20.5'N., 131°38.7'W.	57°03.1'N., 135°20.5'W.	58°10.0'N., 136°38.3'W.	60°06.0'N., 149°26.0'W.	61°14.2'N., 149°53.3'W.	57°47.1'N., 152°25.1'W.	54°20.0'N., 164°45.0'W.	51.6'N., 178°37.6'W.	19°44.1'N., 153°03.5'W.	20°02.9'N., 153°49.9'W.	20°54.0'N., 156°28.2'W.	21°18.5'N., 157°52.3'W.	21°20.0'N., 157°58.3'W.	21°37.4'N., 158°21.5'W.	21°54.1'N., 158°35.6'W.	28°13.0'N., 177°32.0'W.
2939	95	33°43.0'N., 117°10.5'W.	33°46.2'N., 118°13.3'W.	33°45.0'N., 119°16.2'W.	37°48.5'N., 122°24.0'W.	46°11.7'N., 123°50.0'W.	45°33.0'N., 124°41.7'W.	48°26.0'N., 124°47.0'W.	48°31.0'N., 125°00.0'W.	47°36.2'N., 122°20.3'W.	55°20.5'N., 131°38.7'W.	57°03.1'N., 135°20.5'W.	58°10.0'N., 136°38.3'W.	60°06.0'N., 149°26.0'W.	61°14.2'N., 149°53.3'W.	57°47.1'N., 152°25.1'W.	54°20.0'N., 164°45.0'W.	51.6'N., 178°37.6'W.	19°44.1'N., 153°03.5'W.	20°02.9'N., 153°49.9'W.	20°54.0'N., 156°28.2'W.	21°18.5'N., 157°52.3'W.	21°20.0'N., 157°58.3'W.	21°37.4'N., 158°21.5'W.	21°54.1'N., 158°35.6'W.	28°13.0'N., 177°32.0'W.
3270	455	374	371	367	362	357	352	347	342	337	332	327	322	317	312	307	302	297	292	287	282	277	272	267	262	257
3803	988	908	904	897	892	887	882	877	872	867	862	857	852	847	842	837	832	827	822	817	812	807	802	797	792	787
3888	1074	992	989	982	977	972	967	962	957	952	947	942	937	932	927	922	917	912	907	902	897	892	887	882	877	872
3920	1104	1024	1020	1013	1008	1003	998	993	988	983	978	973	968	963	958	953	948	943	938	933	928	923	918	913	908	903
4044	1228	1148	1144	1137	1132	1127	1122	1117	1112	1107	1102	1097	1092	1087	1082	1077	1072	1067	1062	1057	1052	1047	1042	1037	1032	1027
4347	1575	1497	1493	1486	1481	1476	1471	1466	1461	1456	1451	1446	1441	1436	1431	1426	1421	1416	1411	1406	1401	1396	1391	1386	1381	1376
4538	1723	1643	1639	1632	1627	1622	1617	1612	1607	1602	1597	1592	1587	1582	1577	1572	1567	1562	1557	1552	1547	1542	1537	1532	1527	1522
4603	1787	1707	1703	1696	1691	1686	1681	1676	1671	1666	1661	1656	1651	1646	1641	1636	1631	1626	1621	1616	1611	1606	1601	1596	1591	1586
4940	2124	2043	2040	2033	2028	2023	2018	2013	2008	2003	1998	1993	1988	1983	1978	1973	1968	1963	1958	1953	1948	1943	1938	1933	1928	1923
5117	2307	2223	2220	2213	2208	2203	2198	2193	2188	2183	2178	2173	2168	2163	2158	2153	2148	2143	2138	2133	2128	2123	2118	2113	2108	2103
5228	2412	2331	2328	2321	2316	2311	2306	2301	2296	2291	2286	2281	2276	2271	2266	2261	2256	2251	2246	2241	2236	2231	2226	2221	2216	2211
5604	2806	2725	2722	2715	2710	2705	2700	2695	2690	2685	2680	2675	2670	2665	2660	2655	2650	2645	2640	2635	2630	2625	2620	2615	2610	2605
4527	2175	2143	2140	2133	2128	2123	2118	2113	2108	2103	2098	2093	2088	2083	2078	2073	2068	2063	2058	2053	2048	2043	2038	2033	2028	2023
4594	2219	2187	2180	2175	2170	2165	2160	2155	2150	2145	2140	2135	2130	2125	2120	2115	2110	2105	2100	2095	2090	2085	2080	2075	2070	2065
4609	2212	2173	2170	2163	2158	2153	2148	2143	2138	2133	2128	2123	2118	2113	2108	2103	2098	2093	2088	2083	2078	2073	2068	2063	2058	2053
4685	2278	2236	2233	2226	2221	2216	2211	2206	2201	2196	2191	2186	2181	2176	2171	2166	2161	2156	2151	2146	2141	2136	2131	2126	2121	2116
4690	2283	2241	2238	2231	2226	2221	2216	2211	2206	2201	2196	2191	2186	2181	2176	2171	2166	2161	2156	2151	2146	2141	2136	2131	2126	2121
4767	2330	2284	2281	2274	2269	2264	2259	2254	2249	2244	2239	2234	2229	2224	2219	2214	2209	2204	2199	2194	2189	2184	2179	2174	2169	2164
4777	2347	2302	2299	2292	2287	2282	2277	2272	2267	2262	2257	2252	2247	2242	2237	2232	2227	2222	2217	2212	2207	2202	2197	2192	2187	2182
5707	3087	3034	3031	3024	3019	3014	3009	3004	2999	2994	2989	2984	2979	2974	2969	2964	2959	2954	2949	2944	2939	2934	2929	2924	2919	2914

* Via inside passage

Table 7. Hawaii Distances

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Table 9. Climatic Data, Hilo, Hawaii (General Lyman Airport) 19°43'N 155°04'W. Elevation (ground) 31 feet. WB-1961

Month	Air Temperature (Degrees Fahrenheit)				Precipitation (Inches)		Humidity (Percent)		Wind (Knots)		Percent of Possible Sunshine	Mean Sky Cover-Sunrise to Sunset	Sunrise to Sunset			Snow, Sleet or Haze	Thunder-storms	Heavy Fog		
	Normal		Extreme		Normal Total	Maximum in 24 Hours	Snow, Sleet, Mean Total	8:00 a.m. MST	2:00 p.m. MST	Mean Speed			Prevailing Direction	Maximum Speed and Direction	Clear				Partly Cloudy	Cloudy
	Daily Maximum	Daily Minimum	Record Highest	Record Lowest																
(a)			15	15	19	19	12	12	12	12	11	15	15	15	19	19	16	16		
January	78.4	62.4	89	55	14.23	9.94	0	80	67	6.5	SW	46	6.8	5	11	15	0	0	0	
February	79.0	62.4	79.7	55	6.48	13.41	0	82	69	6.8	SW	41	7.1	3	10	15	0	2	0	
March	78.5	63.1	70.8	88	55	15.72	9.18	0	81	67	6.8	SW	41	7.7	2	10	23	0	1	
April	79.2	64.0	71.6	87	56	13.27	9.39	0	82	69	6.5	33	8.2	1	7	22	25	0	1	
May	81.1	65.1	73.1	85	58	9.00	5.94	0	81	69	6.3	31	8.2	1	9	23	25	0	0	
June	82.5	66.3	74.4	88	60	6.75	2.25	0	79	65	6.3	42	7.5	2	11	17	24	0	0	
July	82.6	67.0	74.8	88	62	9.89	5.42	0	82	67	6.3	44	7.6	1	12	18	28	0	0	
August	83.1	67.7	75.4	93	63	11.92	9.27	0	83	70	6.3	38	7.9	1	9	21	27	0	0	
September	83.0	67.5	75.3	92	62	10.42	6.02	0	80	66	6.2	41	7.1	2	12	16	24	0	0	
October	81.1	66.8	74.5	91	62	11.02	8.88	0	81	68	6.0	40	7.4	2	11	18	25	0	1	
November	80.7	65.7	72.0	88	58	12.99	15.99	0	83	71	5.8	32	7.6	2	9	19	24	0	1	
December	78.8	64.0	71.4	85	56	15.99	10.90	0	82	71	6.4	37	7.4	3	10	19	24	0	0	
Year	80.7	65.2	73.0	93	55	139.98	15.99	0	81	68	6.3	39	7.5	25	121	219	287	0	6	

Table 10. Climatic Data, Lihue, Hawaii (Lihue Airport) 21°59'N 159°21'W. Elevation (ground) 115 feet. WB-1961

Month	Air Temperature (Degrees Fahrenheit)				Precipitation (Inches)		Humidity (Percent)		Wind (Knots)		Percent of Possible Sunshine	Mean Sky Cover Sunrise to Sunset	Sunrise to Sunset			Mean Number of Days			Thunderstorms	Heavy Fog	
	Normal		Extreme		Maximum Total	Maximum in 24 Hours	Snow, Sleet, Mean Total	8:00 a.m. HST	2:00 p.m. HST	Mean Speed			Prevailing Direction	Maximum Speed and Direction	Clear	Partly Cloudy	Cloudy	Precipitation 0.01 inch or More			Snow, Sleet 1.0 inch or More
	Daily Maximum	Daily Minimum	Monthly	Record Highest																	
(a)																					
January	77.4	62.7	70.1	84	6.23	11.09	0.0	84	67	8.9	ENE	31 SW	5.9	8	12	11	15	0	1	0	
February	77.7	62.5	70.1	86	5.3	4.44	0.0	82	67	10.0	NE	30 E	6.4	6	11	11	16	0	1	0	
March	77.7	63.5	70.6	85	5.1	4.07	0.0	79	65	9.9	NE	31 N	6.6	5	14	12	16	0	1	0	
April	78.2	65.7	72.0	87	5.6	3.03	1.50	76	66	10.4	NE	25 NE	7.1	4	12	14	15	0	1	0	
May	79.8	68.3	74.1	85	5.9	2.51	3.30	75	65	10.8	NE	43 NE	6.9	3	14	14	16	0	1	0	
June	81.2	71.1	76.2	88	6.4	1.65	0.80	75	65	10.9	NE	26 NE	6.6	3	15	12	17	0	1	0	
July	82.4	72.4	77.4	88	6.5	1.87	5.54	76	65	10.9	NE	27 NE	6.5	3	18	10	20	0	1	0	
August	83.3	72.9	78.1	89	6.6	2.27	5.43	76	66	11.2	NE	43 NE	6.7	3	16	12	19	0	1	0	
September	83.6	72.0	77.8	89	6.5	2.20	1.98	77	65	9.7	NE	38 NE	6.2	6	14	18	16	0	1	0	
October	82.6	70.3	76.5	90	6.3	4.63	4.99	79	67	9.1	NE	28 E	6.2	5	14	12	19	0	1	0	
November	79.7	67.5	73.6	86	5.7	4.24	11.20	81	69	10.2	NE	27 S	6.4	4	14	12	18	0	1	0	
December	77.8	65.2	71.5	85	5.32	5.35	5.40	80	68	9.9	NE	40 E	6.5	5	14	12	18	0	1	0	
Year	80.1	67.8	74.0	90	5.1	42.49	11.20	78	66	10.2	NE	43 NE	6.5	55	170	140	205	0	8	0	

Table 11. Mean Surface Water Temperatures and Salinities

Station	Years	January		February		March		April		May		June		July		August		September		October		November		December		Mean	
		Temp. °F	Sal. ‰	Temp. °F	Sal. ‰	Temp. °F	Sal. ‰	Temp. °F	Sal. ‰	Temp. °F	Sal. ‰	Temp. °F	Sal. ‰	Temp. °F	Sal. ‰	Temp. °F	Sal. ‰	Temp. °F	Sal. ‰	Temp. °F	Sal. ‰	Temp. °F	Sal. ‰	Temp. °F	Sal. ‰	Temp. °F	Sal. ‰
Honolulu, Hawaii 21°18' N 157°52' W	18	76.0	34.2	76.0	34.5	75.9	34.5	76.6	34.8	77.6	34.8	78.7	34.9	79.8	34.9	80	34.9	80.5	34.9	80.4	34.9	78.8	34.8	77.0	34.8	78.1	34.7
Kaunohie Bay, Hawaii 21°06' N 157°48' W	6	73.1	34.5	72.9	34.4	74.0	34.0	75.2	34.4	77.0	34.6	79.3	35.0	79.4	35.0	80.0	35.0	79.6	35.1	79.1	34.9	76.3	34.4	73.2	34.4	76.6	34.6
Makery Islands 28°13' N 177°22' W	16	67.6	35.5	67.2	35.5	68.4	35.5	69.8	35.7	72.6	35.8	77.0	35.8	79.4	35.9	80.3	35.8	80.4	35.8	77.3	35.7	73.7	35.8	70.5	35.5	73.7	35.7

‰. This symbol denotes the salinity of sea water, and is defined as the number of grams of salts in 1,000 grams of sea water. For sea water temperature and salinity in greater detail, see Coast and Geodetic Survey Publication 31-5, Surface Water Temperature and Salinity, Pacific Coast, North and South America and Pacific Ocean Islands.

Table 12. Climatic Data, Kauai, Comparing Leeward Stations With Upland Stations

Station Elevation (Feet) Years of Record	Coastal		Upland		
	Maka 11 54	Kekaha 9 64	Poohu Ridge 1,660 19	Kamaleihulu 3,600 4	
	Average Temperature (Degrees Fahrenheit)	Average Rainfall (Inches)	Average Rainfall (Inches)	Average Rainfall (Inches)	Average Rainfall (Inches)
January	70.5	3.77	3.70	6.04	14.53
February	70.7	2.43	2.83	5.44	14.19
March	71.0	2.23	2.16	3.10	6.10
April	72.4	1.41	1.21	2.76	3.20
May	74.6	0.99	0.79	2.01	1.55
June	76.4	0.82	0.61	0.97	1.24
July	77.4	0.79	0.60	1.13	2.74
August	78.1	1.23	1.09	2.10	2.56
September	77.6	0.97	0.77	1.18	2.40
October	76.3	1.63	1.62	1.55	4.69
November	73.8	1.84	1.55	2.19	10.62
December	71.4	3.37	3.44	5.11	12.58
Annual average	74.2	21.58	20.37	32.58	76.40
Extreme high	92 (1950)	42.46 (1951)	45.99 (1951)	65.04 (1951)	85.72 (1956)
Extreme low	50 (1950)	10.39 (1953)	6.85 (1953)	18.08 (1952)	65.09 (1958)

Table 13. Rainfall Data, Kauai, Selected Stations

Stations	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Anahola, latitude missing, longitude missing, elevation 70 feet													
Average, 7 years	5.33	5.20	6.06	3.99	3.57	1.73	2.40	2.94	3.64	5.68	4.73	4.53	49.90
Hanalei, latitude 22°13' N, longitude 159°30' W, elevation 10 feet													
Average, 18 years	6.48	9.83	15.02	7.90	6.36	5.28	6.67	8.35	6.40	7.61	9.24	9.31	98.50
Maximum, 24 hours, 5 years	5.30	8.00	5.60	3.48	3.10	2.80	2.99	8.00	4.70	2.23	3.85	4.13	8.00
Number days 5 years	15	12	19	15	14	14	14	17	13	17	14	19	183
Hanalei, latitude 22°00' N, longitude 159°21' W, elevation 175 feet													
Average, 46 years	7.51	4.81	6.72	3.88	3.37	2.52	3.29	2.91	3.66	4.59	5.90	6.53	55.69
Maximum, 24 hours, 34 years	12.80	6.85	7.84	6.98	5.99	3.46	19.94	3.16	9.58	10.45	9.00	13.01	19.94
Number days 34 years	13	11	14	12	13	13	15	15	15	16	15	14	166
Hiloa Manawaloapuna Divide, latitude 22°01' N, longitude 159°32' W, elevation 2,030 feet													
Average, 29 years	21.38	12.91	17.61	17.27	17.46	16.32	20.74	20.05	19.51	16.23	19.72	19.63	218.85
Homestead, latitude 21°56' N, longitude 159°32' W, elevation 700 feet													
Average, 29 years	6.91	3.96	4.96	3.52	3.11	3.11	4.04	3.62	4.27	4.21	5.16	5.90	53.02
Maximum, 24 hours, 29 years	8.25	5.50	9.05	4.40	2.15	6.03	4.17	3.63	3.50	2.95	6.67	3.70	9.05
Number days 28 years	15	11	12	10	13	13	17	15	15	15	14	14	164
Palu Trail, latitude 21°58' N, longitude 159°40' W, elevation 850 feet													
Average, 5 years	2.39	1.72	1.82	1.37	1.22	0.51	0.42	0.17	1.58	1.44	1.20	1.97	15.81
Papuna, latitude 21°58' N, longitude 159°28' W, elevation 518 feet													
Average, 24 years	11.39	6.43	10.53	7.54	7.21	5.96	7.77	8.08	7.62	8.32	8.33	10.92	100.30
Maximum, 24 hours, 20 years	10.45	10.54	8.47	4.94	5.14	10.02	7.85	6.09	4.07	4.13	5.85	20.75	20.75
Number days 20 years	19	16	19	19	22	22	27	26	24	22	19	18	253
West Lawai, latitude 21°54' N, longitude 159°31' W, elevation 240 feet													
Average, 37 years	5.64	3.65	5.12	2.84	2.33	2.07	2.85	2.85	3.28	3.43	4.06	4.88	43.00
Maximum, 24 hours, 34 years	8.76	3.20	8.55	6.61	2.86	4.40	2.15	5.50	4.13	3.36	8.80	4.60	8.80
Number days 34 years	13	10	12	12	13	13	17	16	15	14	12	14	161

Table 14. Monthly Temperatures, Extreme Temperature Ranges, and Number of Days of Observations for Barking Sands

Month	Average Maximum (Degrees Fahrenheit)	Average Minimum (Degrees Fahrenheit)	Absolute Range (Degrees Fahrenheit)	Days
January	80	65	84 to 59	91
February	80	65	85 to 56	85
March	80	65	85 to 60	93
April	82	66	87 to 62	94
May	84	68	88 to 65	93
June	86	69	90 to 67	107
July	86	70	91 to 67	124
August	87	70	90 to 67	124
September	86	70	90 to 65	120
October	85	69	91 to 65	124
November	85	68	86 to 62	120
December	81	65	89 to 59	124
Annual	83	67	91 to 56	1,301

PROCLAMATIONS

No. 3309

August 25, 1959, 24 F.R. 6868

**ADMISSION OF THE STATE OF HAWAII INTO THE UNION
BY THE PRESIDENT OF THE UNITED STATES OF AMERICA
A PROCLAMATION**

WHEREAS the Congress of the United States by the act approved on March 18, 1959 (73 Stat. 4),¹ accepted, ratified, and confirmed the constitution adopted by a vote of the people of Hawaii in an election held on November 7, 1950, and provided for the admission of the State of Hawaii into the Union on an equal footing with the other States upon compliance with certain procedural requirements specified in that act; and

WHEREAS it appears from the information before me that a majority of the legal votes cast at an election of June 27, 1959, were in favor of each of the propositions required to be submitted to the people of Hawaii by section 7(b) of the act of March 18, 1959; and

WHEREAS it further appears from information before me that a general election was held on July 18, 1959, and that the returns of the general election were made and certified as provided in the act of March 18, 1959; and

WHEREAS the Governor of Hawaii has certified to me the results of the submission to the people of Hawaii of the three propositions set forth in section 7(b) of the act of March 18, 1959, and the results of the general election; and

WHEREAS I find and announce that the people of Hawaii have duly adopted the propositions required to be submitted to them by the act of March 18, 1959, and have duly elected the officers required to be elected by that act:

NOW, THEREFORE, I, DWIGHT D. EISENHOWER, President of the United States of America, do hereby declare and proclaim that the procedural requirements imposed by the Congress on the State of Hawaii to entitle that State to admission into the Union have been complied with in all respects and that admission of the State of Hawaii into the Union on an equal footing with the other States of the Union is now accomplished.

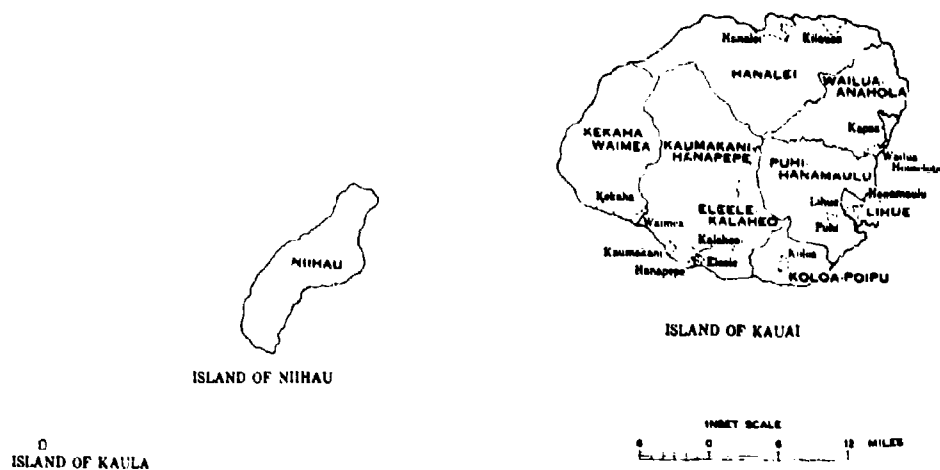
IN WITNESS WHEREOF, I have hereunto set my hand and caused the Seal of the United States of America to be affixed.

Done at the City of Washington at four p. m. E.D.T. on this twenty-first day of August in [SEAL] the year of our Lord nineteen hundred and fifty-nine, and of the Independence of the United States of America the one hundred and eighty-fourth.

DWIGHT D. EISENHOWER

CHRISTIAN A. HERTER,
Secretary of State.

Figure 13. Proclamation of Admission of the State of Hawaii Into the Union.



KAUAI COUNTY

Kauai County	28,176
Elele-Kalaheo division	4,212
Hanapepe (U)	384
Kalaheo (U)	1,185
Hanalei division	1,312
Kapaa division	3,439
Kapaa (U)	3,439
Kaumakani-Hanapepe division	2,834
Hanapepe (U)	999
Kekaha-Waimea division	3,969
Kekaha (U)	2,082
Waimea (U)	1,312
Koloa-Poipu division	2,800
Koloa (U)	1,426
Lihue division	4,106
Lihue (U)	3,908
Niihau division	254
Puihi-Hanamaulu division	2,191
Wailua-Anahola division	3,059
Wailua Houselots (U)	1,129

"U" denotes an unincorporated place.

Figure 14. Population of Kauai County by Census Divisions, 1960.

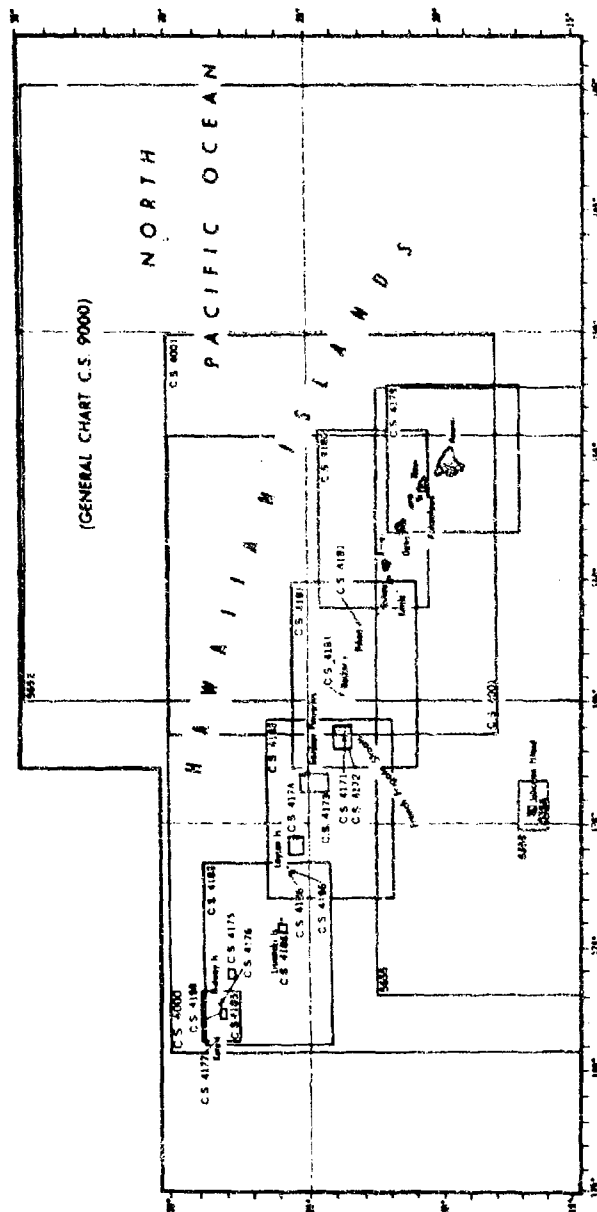


Figure 15. Graphic index of U.S. Oceanographic Office and U.S. Coast and Geodetic Survey Charts: Hawaiian Islands.

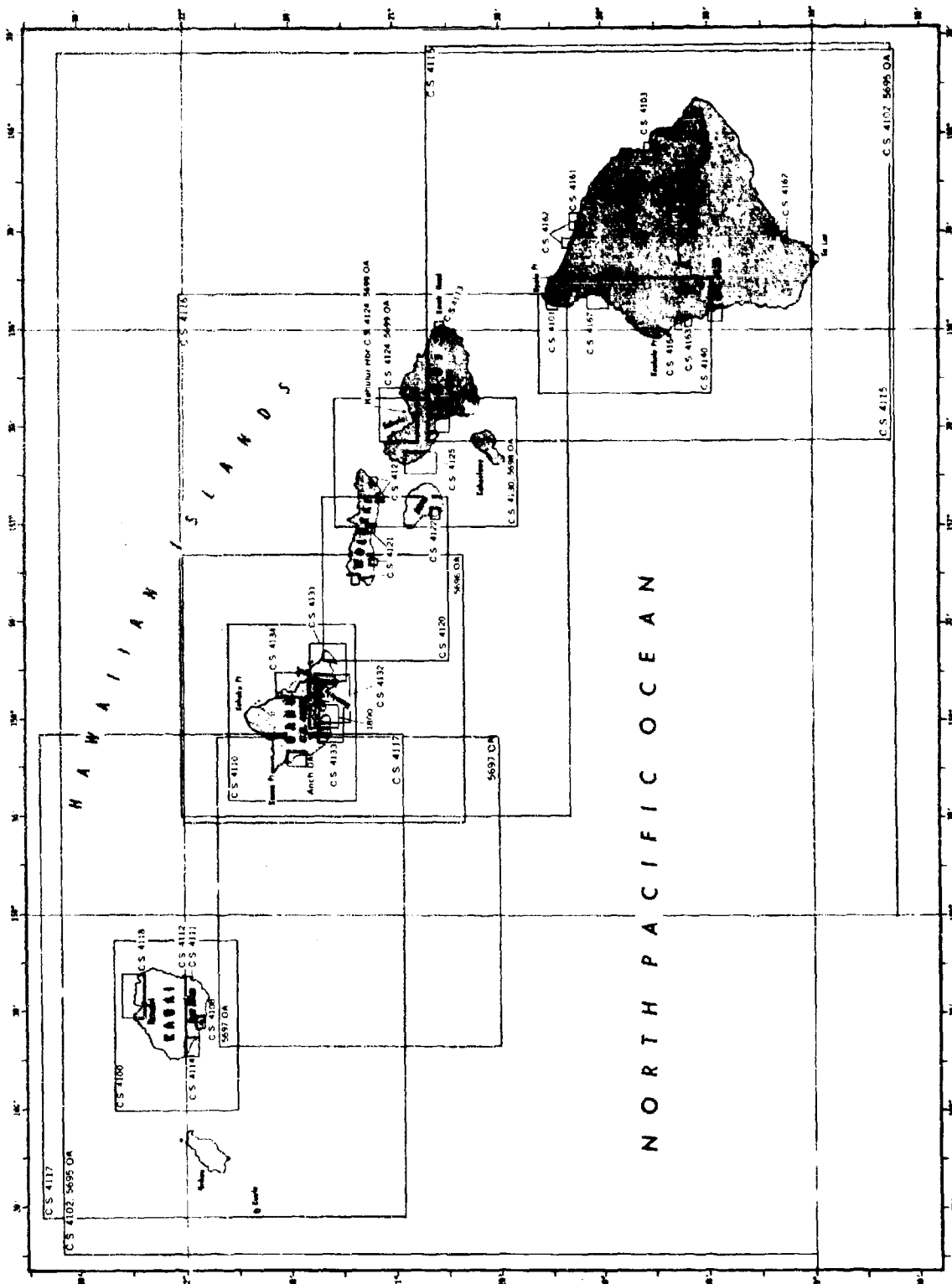
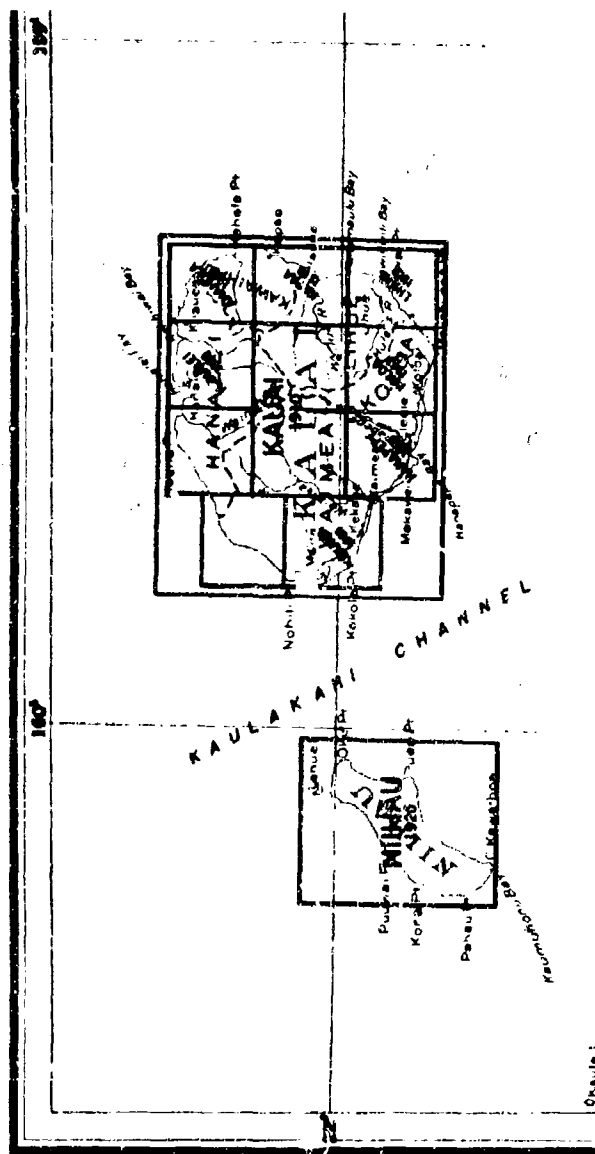


Figure 16. Graphic Index of U.S. Oceanographic Office and U.S. Coast and Geodetic Survey Charts: Hawaii to Nihoa.

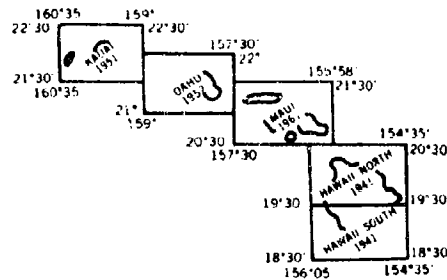


Kauai (Island), Hawaii. This map shows the island of Kauai, which is also the county of Kauai.

Limiting parallels, $21^{\circ}50'$ and $22^{\circ}15'$. Limiting meridians, $159^{\circ}15'$ and $159^{\circ}50'$. Scale, 1:62,500, or about 1 mile to 1 inch. Contour interval, 50 feet. Size, 33 by 43 inches. 1910. Price, \$1.

Niihau (Island), Hawaii. This map shows the island of Niihau. Limiting parallels, $21^{\circ}46'$ and $22^{\circ}02'$. Limiting meridians, $160^{\circ}02'$ and $160^{\circ}15'$. Scale, 1:62,500, or about 1 mile to 1 inch. Contour interval, 50 feet. Size, 19 by 22 inches. 1926. Price, 50 cents.

Figure 17. Index of U.S. Geological Survey Maps Available for Kauai and Niihau.



United States Series of Topographic Maps. This is a series of topographic maps produced by the Army Map Service, and published and distributed for civilian use by the Geological Survey. The following maps cover areas in Hawaii:

Hawaii North. Limiting parallels, $19^{\circ}30'$ and $20^{\circ}30'$. Limiting meridians, $154^{\circ}35'$ and $156^{\circ}05'$. Contour interval, 200 feet. Size, 22 by 34 inches. 1941. Also available in a woodland edition.

Hawaii South. Limiting parallels, $18^{\circ}30'$ and $19^{\circ}30'$. Limiting meridians, $154^{\circ}35'$ and $156^{\circ}05'$. Contour interval, 200 feet. Size, 22 by 32 inches. 1941. Also available in a woodland edition.

Kauai. Limiting parallels, $21^{\circ}30'$ and $22^{\circ}30'$. Limiting meridians, 159° and $160^{\circ}35'$. Contour interval, 200 feet, with supplementary contours at 100-foot intervals. Size, 24 by 29 inches. 1951.

Maui. Limiting parallels, $20^{\circ}30'$ and $21^{\circ}30'$. Limiting meridians, $155^{\circ}58'$ and $157^{\circ}30'$. Contour interval, 200 feet. Size, 24 by 29 inches. 1961. Available in a woodland edition only.

Oahu. Limiting parallels, 21° and 22° . Limiting meridians, $157^{\circ}30'$ and 159° . Contour interval, 200 feet. Size, 22 by 34 inches. 1952.

Figure 18. Index of Army Map Service/Geological Survey 1:250,000 Scale Maps of the Hawaiian Islands.



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<p>This technical note is intended to provide geographic and other background information to persons who have an interest in the Pacific Missile Range facilities at Barking Sands, Kauai, and in the State of Hawaii of which Kauai is a part.</p> <p>The information set forth herein should be both useful and interesting to residents and visitors alike.</p>		

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KEY WORDS	LINK A		LINK B		LINK C	
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Geography Hawaiian Islands Island of Kauai BARSTUR Meteorological data Oceanographic data Charts and maps						

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